STUDY GUIDE

ELECTROPLATING & METAL FINISHING

SUBCLASS L

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ELECTROPLATING AND METAL FINISHING
WASTEWATER TREATMENT
OBJECTIVES

PURPOSE FOR REGULATIONS

1. Identify some reasons for confronting toxic wastes from electroplating and metal finishing industrial facilities.

2. Explain the parts of a municipal sewer use ordinance.

3. Discuss the regulated parameters for electroplating and metal finishing discharges.

4. Describe the document which would list categorical metal finishing and electroplating limits.

PRINCIPLES OF ELECTROPLATING AND METAL FINISHING WASTE TREATMENT

5. Identify the types of electroplating and metal finishing operations which may generate metal or organic wastestreams.

6. Describe the advantages of treating individual versus combined wastestreams.

7. List several waste sources from metal finishing process lines, and identify which are the greatest source of heavy metals.

8. Identify electroplating and metal finishing wastes which must be treated separately.

9. Identify some of the most common treatment and removal methods for the following:

   A. Chromium.
   B. Cyanide.
   C. Grease and Oil.
   D. Copper.
   E. Lead.
   F. Nickel.
   G. Zinc.

10. List the optimum pH range for the most common treatment and removal processes.

11. Explain batch versus continuous flow through type treatment processes.

12. List the common treatment processes used to remove oil and water wastes.

13. Discuss the importance of mixing devices in removing metals from industrial wastestreams.

14. Describe how suspended metal hydroxide precipitates might be further reduced in clarifier effluents.

15. Explain why the addition of hydrogen sulfide or soluble sulfides might be better in getting greater heavy metal removal than metal hydroxide precipitation.

16. Discuss how ion exchange is utilized in industrial wastewater treatment to treat or polish electroplating/metal finishing effluents.

17. Identify the use of the following in the industrial waste treatment process.

    A. Sodium Hydroxide.
    B. Sulfuric Acid.
    C. Sodium Hypochlorite.
    D. Sodium Bisulfite.
    E. Aluminum Sulfate.
    F. Hydrochloric Acid.
    G. Carbon.
    H. Calcium Oxide.
    I. Polymers.

18. Classify coagulants and/or polymers used in metal finishing waste treatment based on their respective charges.

19. Define the term oxidation.

20. Define the term reduction.

21. Identify where cyanide compounds are typically used in electroplating or metal finishing.

22. List some methods for recycling of precious metals from metal wastestreams.

23. Explain what must be done to achieve a homogenous mixture in a wastewater treatment system.

24. Explain how each of the following pumps would mechanically move liquid:

    A. Centrifugal.
    B. Screw.
    C. Piston.
    D. Air Lift.
    E. Diaphragm.

pH ADJUSTMENT/HYDROXIDE PRECIPITATION

25. List some ways to reduce hydraulic loading on an industrial waste treatment system.

26. Predict the reduction of water usage based on the number of counter flow.

27. Describe the chemicals used to lower the pH of alkaline wastes.

28. Describe the chemicals used to raise the pH of acid wastes.

29. Discuss the location of a pH probe in an industrial waste treatment tank to get the most accurate reading of tank pH.

30. If given chart of idealized solubility product curves of metal concentrations versus ph, identify the optimum pH for a specific metal's removal.

31. Identify how to determine the best pH in a coprecipitation situation.

32. Explain the proper operation and deposition for metal hydroxide sludges.

33. Discuss why chelating agents can affect metal hydroxide precipitation.

34. Identify some problems or limitations typically encountered in hydroxide ion precipitation.

CYANIDE OXIDATION

35. Describe why cyanide is so dangerous to humans, and what safety precautions must be taken in treating cyanide wastes.

36. Discuss what the cyanide exposure limits are for various concentrations limits, and how they can be measured.

37. Explain the stages and chemical reactions of cyanide destruction by chlorination.

38. Explain why the liberation of cyanogen chloride gas or toxic cyanide gas would be a problem, and how this can be avoided.

39. Discuss how pH related to the oxidizing potential of cyanide and how pH and ORP probes are used to control the process of oxidation of cyanide.

40. Describe batch and continuous processes affect the cyanide destruct process.

HEXAVALENT CHROME REDUCTION

41. List the typical electroplating and metal finishing processes which produce hexavalent chromium bearing wastewater.

42. Explain why hexavalent chromium must be reduced to trivalent chromium in order to remove it from the industrial wastestreams.

43. Identify what chemicals might be used to reduce hexavalent chromium to trivalent chromium.

44. State what pH must be established to reduce hexavalent to trivalent chromium using sulfuric acid and sodium bi-sulfite.

45. Explain how an operator would know if the hexavalent chromium has been sufficiently reduced to trivalent chromium.

ORGANICS REMOVAL

46. Identify how organic compounds are most typically removed from wastestreams.

47. State what chemical would most typically be used to remove organic compounds from wastestreams.

48. List some typical organic cleaners.

WASTE REDUCTION & MINIMIZATION

49. Identify some common mechanisms which industry might use to reduce treatment costs.

MONITORING AND OPM PROCEDURES

50. Contrast how acidity and alkalinity are measured as opposed to high and low pH, and explain what the differences are.

51. Explain how a jar test apparatus might be used to determine the best pH to precipitate the metals in an industrial wastestream.

52. Discuss the reasons for cleaning pH and ORP probes.

53. Describe the frequency of cleaning pH and ORP probes.

54. Explain the typical procedure for cleaning a pH electrode for the folowing:

    1. Metallic Hydroxides.
    2. Oil and Grease.

55. Describe the calibration of a pH probe and meter.

56. Discuss which common factors might affect pH measurement.

57. Identify the numeric values of common buffers used in the standardization of a pH electrode and meter.

58. Discuss pH probe placement in a wastewater treatment system.

59. Describe the procedure for calibrating an ORP probe.

60. Describe the operations necessary for collecting a truly representative flow proportional or grab sample.

61. Discuss preservation techniques used in proper sample storage.

62. Discuss how to set up a sampling program as it applies to regulation and system efficiency.

63. Explain what information must go on the sample lable and collecting slip. Explain the phrase "chain of custody" as it relates to sampling.

64. Identify which pieces of flow measuring equipment would be the best for industrial wastewater applications.

65. Discuss the use of pH paper versus pH meters in the measurement of pH.

66. Describe how treatment tank levels are typically controlled.

67. Discuss the use of various tank level controllers.

SAFETY

68. Describe some of the most common information included on material safety data sheets.

69. Identify what a material safety data sheet (MSDS) is, and explain its importance in the workplace.

70. List some treatment chemicals that would be incompatible with one another.

71. Identify the one single safety factor which must be observed when highly acidic or basic solutions are mixed.

72. Explain the conditions for spill containment for chemical storage.

73. List the safety factors that must be addressed when the following chemicals are mixed with water:

    A. HCS.
    B. H_2SO_4.
    C. CaO_3.
    D. NaOH.
    E. Sodium Bisulfite.

74. Discuss how acids are properly contained and stored.

75. Identify the proper safety precautions when dealing with acids.

76. List the safety equipment that must be used when handling strong acids and bases.

77. Identify why cyanide is so dangerous to humans, and what safety precautions must be taken in treating cyanide wastes.

78. List the cyanide exposure limits for various concentration limits and how they can be measured.

CALCULATIONS

79. Be able to make conversions of commonly used solution concentrations.

80. Calculate percent by weight of solutions when given the weight of solute and weight of solvent.

81. Calculate percent by volume when given weight of solute and volume of solvent.

82. Calculate the percent reduction in an industry's flow when the effluent volume is reduced.

83. Calculate the pounds of chemical in the waste stream if given effluent flow and concentration of chemical,

84. Be capable of performing a polymer calculation for the following:

    A. Compute flow rate of wastewater.
    B. Convert waste flow.
    C. Determine polymer dosage.
    D. Determine polymer pumpage rate.
    E. Prepare a specific polymer concentration.
    F. Calculate total polymer that has to be added to the tank.

85. When supplied with a list of hourly flow data, calculate the correct volume of sample to collect in order to have a flow proportional composite.

RESOURCES

1. **TREATMENT OF METAL WASTESTREAMS**. First Edition, Kenneth D. Kerri, California State University, 6000 J Street, Sacramento, CA 95819-6025. Phone (916) 278-6142.